

DESCRIPTIONS OF TWO NEW TRILOBITES, AND NOTE ON
GRIFFITHIDES CONVEXICAUDATUS MITCHELL.

By JOHN MITCHELL, late Principal of the Newcastle Technical College and
 School of Mines, Newcastle, N.S. Wales.

(Plate liv.)

[Read 29th November, 1922.]

PHILLIPSIA CONVEXICAUDATA.

Griffithides convexicaudatus, Mitchell, Proc. Linn. Soc. N.S.W., 43, 1918, 475-9, Pl. xlvi., fig. 13, Pl. xlvi., figs. 1-3, Pl. lii., figs. 5, 6.

Recently Mrs Pincombe, of Lambton, had the good fortune to find a perfect specimen of a trilobite, belonging to the genus *Phillipsia*, at the same locality on the Glen William Road, near Clarencetown, as *Griffithides convexicaudatus* Mitch., was found some years ago. This fine specimen has been passed on to me for identification and description, for which I am very thankful, as it enables me to revise my former description and conclusions regarding the generic position of that species. In the first place, after much careful study of this new specimen in conjunction with *G. convexicaudatus* Mitch., I find the differences insufficient to justify their specific separation; and as the new fossil is a *Phillipsia*, the species *convexicaudatus* must be transferred to that genus. Between the two there are small differences;—for instance, in the original type the thorax and pygidium are of equal length, and the cephalon so little shorter than either of these that the three parts may be accepted as almost equal; in the case of the new form the lengths of these parts are: head, 3.9 mm., thorax, 4.7 mm., tail, 3.9 mm., but the latter is, if they are specifically identical, not more than half mature, and this may account for the discrepancies in the relative dimensions. Another difference appears in the eyes: those of the original type seem to be shorter and deeper than those of the other; but the cephalon of the former is very imperfect, and this difference may arise through distortion. The head of the recently-found form shows all the characteristic features of a *Phillipsia* near *P. darbiensis*, and could, it appears to me, be placed as a variety of that species. In a general way every feature of the cephalon of our new trilobite agrees with the similar part of the cephalon of *P. darbiensis*. They are similar in shape, bear similar glabellar furrows, have eyes identical in shape and position and relative size; in fact the head-shields of the two forms are practically identical, and if the specific determination were made on this part of our new form alone, it would certainly be placed with *Phillipsia darbiensis* Martin. The two Austra-

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lian forms agree with the British one in more dimensions than they disagree, as will be seen by a study of the following measurements (in millimetres):

	Length	Width	Head	Thorax	Pygidium
1. <i>P. darbiensis</i>	17.85	10.2	6.2 long	6.2 long	5.45 long
2. <i>G. convexicaudatus</i>	25.0	14.06	7.8 (?)	8.6	8.6
3. New Specimen	12.5	7.8	3.9	4.7	3.9

The ratio of length to width is the same in the first and third and nearly so in the second, the measurements of the separate parts showing variation. In the case of the second specimen it is possible that the measurement given for its head is not correct, because of the damaged state of that part. I am disposed to think that in this fossil the head, thorax, and tail have almost equal lengths; and also that the variation in the length of the thorax of the third arises as a result of its immaturity. It is in the pygidia that the Australian and British examples differ most, as the following dimensions of the pygidia will show:—

	Length	Width	Segments	
			in axis	in pleurae
1. <i>P. darbiensis</i>	6.25	9.38	13	10
2. <i>G. convexicaudatus</i>	9.40	13.00	10	8
3. New specimen	3.90	6.25	10	8

It is thus seen that the ratio between length and width of these three fossils varies little and that practically the only differences worthy of consideration from a specific point of view are those which occur in the number of the segments in their pygidial axis and pleurae. No doubt these are fixed and constant differences and are sufficient to separate the two forms.

Family PROETIDAE.

CORDANIA GARDNERI, n.sp. (Pl. liv., figs. 1-7.)

Spec. Chars. Head-shield subsemicircular, densely tuberculated, strongly inflated. Glabella mildly convex, subcylindrical, relatively short, front gently rounded, sides subparallel, separated from the frontal limb by the continuity of the axial furrows, fairly densely covered with tubercles of different sizes. Basal lobes small, circumscribed, and each bearing two prominent tubercles and other smaller ones; neck-furrow shallow, its lateral extensions interrupted by the tumidity of the fixed cheeks adjacent to the axial furrows, from thence across the free cheeks wide and shallow; occipital ring moderately strong, convex and gently arched backward; lateral extensions ridged, subprominent and granulated. Frontal limb very wide, convex just in front of the glabella, thence concave to the upturned border, the convex portion thickly covered with several irregular rows of head-like tubercles, most dense and largest near the antero-lateral angles of the glabella, the tubercles on the concave portion finer; border, along its outer edge, bears a row of moderately distinct pustules. Fixed cheeks tumid, lower than the glabella; on each, between the palpebral lobe and the axial furrow is a row of four tubercles, of which the anterior one is the largest and enoaches upon the furrow, causing it to indent the glabella. Free cheeks strongly inflated, steep between the eyes at the top and the borders at the bottom, between which they are conspicuously tuberculated; borders abnormally wide, concave between the cheeks and the thickened margins, which concave portions are only finely and sparsely tuberculate; both outer and inner edges of the margins are granulate; the genal angles are produced into stout spines. Eyes small, reniform, apparently faceted, prominent, separated from the cheeks by a distinct furrow, subdistant from the glabella and, for the greater part, in advance of the

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basal lobes. Anteriorly the facial sutures run from the front of the eyes straight to the inner edge of the thickened margin, thence inwardly, passing out at a very acute angle; posteriorly, they extend from the inner angles of the eyes obliquely and pass out near the fulcral angles.

Thorax composed of nine segments, sides subparallel, much wider than long (15.6 : 9.4), length equal to that of the pygidium or of the cephalon, which are approximately of equal length. Axis prominent, spread nearly equal throughout, much wider than one side lobe (approximately 5 : 3); each ring bears some seven nodules, three of which are very prominent, especially the central one, which is also subspinate, a feature of the central node on each ring, giving to the axis a subserrated aspect, more pronounced on the axis of the pygidium. Pleural lobes slope mildly from the axial furrows to the fulcral angles and thence steeply to their margins; the medial furrow of each pleura is narrow and deep, the posterior ridges, which are much stronger than the anterior ones, bear eight or more nodules, of which that on the fulcral angle is most prominent and that adjacent to the axial furrow nearly as prominent; the pleurae imbricate and their ends have a slight forward trend. Axial furrows only moderately defined.

Pygidium semi-elliptic, strongly convex and tuberculated. Axis very prominent, consisting of fourteen or fifteen rings and terminating prominently and bluntly before reaching the margin; the rings are tuberculated in a similar way to those of the thoracic axis, but the central ones of the pygidium are more spinate and recurved than are the similar ones of the thoracic axis and, in consequence, when viewed from the side, the pygidial axis has a more serrated aspect than has the axis of the thorax; these tubercles are arranged so as to form longitudinal rows, both on the axis and on the pleurae, which is also a feature of the tuberculation of the thorax. On the space between the end of the axis and the margin are a number of tubercles similar to those which are on identical positions of several species of *Brachymetopus*.

Side lobes are made up of nine pleurae in each, are strongly convex, slope steeply from the fulcral angles to and across the mildly thickened borders, where their ends are slightly depressed and tuberculated; on each pair of pleurae, except the last, the medial sutures are narrow but distinct; the posterior ridges bear large bead-like tubercles, eight in number on the anterior pleurae, but gradually decreasing to two or three on the ridges of the posterior pair; the anterior ridges also bear rows of smaller tubercles, those on the posterior ridges being so placed as to form longitudinal rows, the most conspicuous of which is that along the fulcral angles; the border is ill-defined, except posteriorly, and when it breaks away along its suture, which is not frequent, the under surface is seen to be striated; axial furrows distinct.

Dimensions: Length, 28 mm., width across the genal angles, 18 mm. From a specimen of which a longitudinal half is almost perfectly preserved, it is found that the cephalon, thorax and pygidium have approximately the same length. In both the thorax and the tail, the proportion of the width to the length is 2 : 1.

The determination of the generic position of this trilobite has proved to be a difficult problem. It does not fit either of the Carboniferous genera, and it therefore becomes a question to decide whether it possesses generic features sufficiently characteristic to justify the establishment of a new genus for its reception.

It seems impossible to place it in the genus *Phillipsia* because on no cephalon of the many of the type examined has a trace of either medial or anterior glabellar furrows been noticed. It resembles *Phillipsia* in the shape of its

basal lobes. Anteriorly the facial sutures run from the front of the eyes straight to the inner edge of the thickened margin, thence inwardly, passing out at a very acute angle; posteriorly, they extend from the inner angles of the eyes obliquely and pass out near the fulcral angles.

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Dimensions: Length, 28 mm., width across the genal angles, 18 mm. From a specimen of which a longitudinal half is almost perfectly preserved, it is found that the cephalon, thorax and pygidium have approximately the same length. In both the thorax and the tail, the proportion of the width to the length is 2 : 1.

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glabella, but the shortness of this and the great width of the limb distinguish it from that group. Other difficulties in the way of placing it with *Phillipsia* are its small eyes and their greater distance from the glabella. In its pygidial features generally, but especially in the ornamentation of this part, it resembles most closely some pygidia of *Brachymetopus*. In the absence of the fine glabellar furrows, it possesses the most important generic feature of *Griffithides*, but it lacks the pyriform and gibbous-fronted glabella; its wide limb, short glabella, eyes faceted and sub-distant from the glabella are also difficulties in the way of placing it with this group. With the *Brachymetopi*, perhaps, it agrees in a greater number of specific features than it does with the members of either of the two other genera referred to above. The bead-like pustulation of its glabella and pygidium strikingly resembles that found on *Br. strzeleckii* McCoy, *Br. uralicus* De Verneuil and *Br. maccoyi* Portlock. Its cephalic border agrees very closely in shape and ornamentation with the borders of the first and last of the three species just referred to. Near the anterior and posterior inner angles of the eyes it bears very pronounced tubercles, similar to two borne in identical positions by *Br. strzeleckii* and, in part, by *Br. uralicus*. Its short cylindrical glabella, wide cephalic limb or border, and small prominent reniform eyes distant from the glabella are features characteristic of the *Brachymetopi*. The genal spines, too, are like those of *Br. maccoyi*. Its small, pustulate basal lobes of the glabella and its occipital lobe are very similar to the like parts of several species of *Brachymetopus*.

If the pygidium of the trilobite now under discussion be compared with the pygidia of the two species *Br. uralicus* and *Br. strzeleckii* referred to above, it will be found that it agrees with each of them in most of its details—the ornamentation of its test generally, the equality of the anterior spread of the axis and the side lobes, in having nearly the same number of rings in the axis and pleurae in each of the side lobes, the same kind of pustulation on the space between the end of the axis and the posterior edge of the margin. This latter feature is one which I have noticed on no pygidia except on those now referred to, belonging to the genus *Brachymetopus*, so that, simple feature as it appears to be, it is one of some significance. When the characteristics of our new trilobite, detailed above, are considered in conjunction with the generic characteristics of the three Carboniferous genera of trilobites, also compared and contrasted with it in the text above, the difficulty of referring it to either of those genera will, I think, be admitted, for these characteristics consist of a very remarkable blending of the generic characteristics of all three, those belonging to *Brachymetopus* (European type) preponderating. But for the absence of the fine glabellar furrows, it might be placed in the genus *Phillipsia*, as a very abnormal species. Except that its glabella is not pyriform and its eyes are small, faceted and subdistant from the glabella, and for the relatively great width of the border of the cephalic shield, a place for it might be found in *Griffithides*. Further, there seems only one feature possessed by this trilobite which stands in the way of placing it with *Brachymetopus*, and that is the presence of facial sutures; and it may be noted here that there is evidence that the process of fusion of the fixed and free cheeks had begun and the obsolescence of the facial sutures was in process of accomplishment, for the majority of the head-shields found have the free cheeks in place, yet the symphysis was not completed and the sutures remain and must be reckoned with. Some writers on trilobites seem to regard these sutures as having generic importance, but others, not less eminent, have not so regarded them. For example, in the genus *Acidaspis*, species which have

glabella, but the shortness of this and the great width of the limb distinguish it from that group. Other difficulties in the way of placing it with *Phillipsia* are its small eyes and their greater distance from the glabella. In its pygidial features generally, but especially in the ornamentation of this part, it resembles most closely some pygidia of *Brachymetopus*. In the absence of the fine glabellar furrows, it possesses the most important generic feature of *Griffithides*, but it lacks the pyriform and gibbous-fronted glabella; its wide limb, short glabella, eyes faceted and sub-distant from the glabella are also difficulties in the way of placing it with this group. With the *Brachymetopi*, perhaps, it agrees in a greater number of specific features than it does with the members of either of the two other genera referred to above. The bead-like pustulation of its glabella and pygidium strikingly resembles that found on *Br. strzeleckii* McCoy, *Br. uralicus* De Verneuil and *Br. maccoyi* Portlock. Its cephalic border agrees very closely in shape and ornamentation with the borders of the first and last of the three species just referred to. Near the anterior and posterior inner angles of the eyes it bears very pronounced tubercles, similar to two borne in identical positions by *Br. strzeleckii* and, in part, by *Br. uralicus*. Its short cylindrical glabella, wide cephalic limb or border, and small prominent reniform eyes distant from the glabella are features characteristic of the *Brachymetopi*. The genal spines, too, are like those of *Br. maccoyi*. Its small, pustulate basal lobes of the glabella and its occipital lobe are very similar to the like parts of several species of *Brachymetopus*.

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their cheeks coalesced are placed with other species in which the facial sutures are present. The same practice occurs in the case of the genus *Ceratocephala*, and to overcome the difficulties surrounding the classification of the species, I might have accepted these cases as precedents and referred it to *Brachymetopus* tentatively.

However, it has been suggested to me by General A. W. Vogdes, of San Diego, Cal., U.S.A., an undoubted authority on trilobites, that a fitting resting place for the one under discussion might be in the genus *Cordania* J. M. Clarke, and, after a careful study of the genus I am persuaded to place it therein. *Cordania* was proposed by J. M. Clarke in 1892, for the reception of four species of *Phaethonides* described by Herrick (Bull. Denison Univ., 4, 1889, pp. 56-59). Since then, five other species have been added. All of the species are from the United States, and all, except *Cordania (Phaethonides) occidentalis* Herrick, from rocks of Devonian age. The exception is from the Carboniferous of the Waverley Group of Ohio, U.S.A. The pygidium of this species closely resembles the pygidium of the local form: the numbers of the segments in the axis and pleurae of each are nearly the same, and the ornamentation and general contour of the two are similar; but they differ much in their head-shields, and in size, the Australian one being much the larger. The pygidium of *Cordania (Phaethonides) spinosus* Herr. (l.c.), from the Devonian of the Waverley group of Licking County, Ohio, U.S.A., has a still greater resemblance to that of our specimens. The contour in each is similar—in the axis of the former there are fourteen rings and nine pairs of pleurae in the side lobes, in the latter these parts are fourteen or fifteen and nine or ten respectively; the spinate tubercles are more numerous on these same parts of the latter than they are on those of the former, though they are similar in character. The head-shields of the two are dissimilar in several respects, and the local one is of larger dimensions. In a general way the Australian form resembles *C. gasepiou* Clarke.

The genus *Cordania*, up to now, was confined to the United States, and the discovery of it in Australian rocks will prove to be of interest. Though in the United States the genus is almost exclusively Devonian, I am, because of the general aspect of the associated fossils, disposed to place the geological age of the Australian specimen as Carboniferous.

My sincere thanks are tendered to General A. W. Vogdes, of San Diego, for ample notes and suggestions which were of much assistance to me in determining the generic position of the trilobite here described. To Mr. Legge, of Legge's Camp, Myall Lakes, I wish to express my indebtedness for help which facilitated the work of collecting from this new locality. The species is dedicated to Master Frank Gardner who was the first to bring specimens of it under my notice, and who, though only thirteen years of age, is a keen student of geology.

Loc. and horizon.—Brambles farm, Myall Lakes, Parish of Eurenderee, County Gloucester, N.S. Wales, associated with *Aviculopecten*, *Spirifera*, *Conularia*, and one or two species of *Productus*, etc. Carboniferous (?); but not the equivalent, it seems to me, of any group of rocks of that age that has hitherto come under my observation in this State.

PTYCHOPARIA MERROTSKII, n.sp. (Pl. liv., figs. 11, 12.)

(For a previous reference to this trilobite see Bull. N. Terr., Dec., 1915.)

Description.—Complete form oval. Head-shield of medium length, semi-circular, smooth. Glabella short, narrow, subconical, mildly convex, sparsely and faintly tuberculate, anterior pair of furrows faint, median and basal pairs fairly

their cheeks coalesced are placed with other species in which the facial sutures are present. The same practice occurs in the case of the genus *Ceratocephala*, and to overcome the difficulties surrounding the classification of the species, I might have accepted these cases as precedents and referred it to *Brachymetopus* tentatively.

However, it has been suggested to me by General A. W. Vogdes, of San Diego, Cal., U.S.A., an undoubted authority on trilobites, that a fitting resting place for the one under discussion might be in the genus *Cordania* J. M. Clarke, and, after a careful study of the genus I am persuaded to place it therein. *Cordania* was proposed by J. M. Clarke in 1892, for the reception of four species of *Phaethonides* described by Herrick (Bull. Denison Univ., 4, 1889, pp. 56-59). Since then, five other species have been added. All of the species are from the United States, and all, except *Cordania (Phaethonides) occidentalis* Herrick, from rocks of Devonian age. The exception is from the Carboniferous of the Waverley Group of Ohio, U.S.A. The pygidium of this species closely resembles the pygidium of the local form: the numbers of the segments in the axis and pleurae of each are nearly the same, and the ornamentation and general contour of the two are similar; but they differ much in their head-shields, and in size, the Australian one being much the larger. The pygidium of *Cordania (Phaethonides) spinosus* Herr. (l.c.), from the Devonian of the Waverley group of Licking County, Ohio, U.S.A., has a still greater resemblance to that of our specimens. The contour in each is similar—in the axis of the former there are fourteen rings and nine pairs of pleurae in the side lobes, in the latter these parts are fourteen or fifteen and nine or ten respectively; the spinate tubercles are more numerous on these same parts of the latter than they are on those of the former, though they are similar in character. The head-shields of the two are dissimilar in several respects, and the local one is of larger dimensions. In a general way the Australian form resembles *C. gasepiou* Clarke.

The genus *Cordania*, up to now, was confined to the United States, and the discovery of it in Australian rocks will prove to be of interest. Though in the United States the genus is almost exclusively Devonian, I am, because of the general aspect of the associated fossils, disposed to place the geological age of the Australian specimen as Carboniferous.

My sincere thanks are tendered to General A. W. Vogdes, of San Diego, for ample notes and suggestions which were of much assistance to me in determining the generic position of the trilobite here described. To Mr. Legge, of Legge's Camp, Myall Lakes, I wish to express my indebtedness for help which facilitated the work of collecting from this new locality. The species is dedicated to Master Frank Gardner who was the first to bring specimens of it under my notice, and who, though only thirteen years of age, is a keen student of geology.

Loc. and horizon.—Brambles farm, Myall Lakes, Parish of Eurenderee, County Gloucester, N.S. Wales, associated with *Aviculopecten*, *Spirifera*, *Conularia*, and one or two species of *Productus*, etc. Carboniferous (?); but not the equivalent, it seems to me, of any group of rocks of that age that has hitherto come under my observation in this State.

PTYCHOPARIA MERROTSII, n.sp. (Pl. liv., figs. 11, 12.)

(For a previous reference to this trilobite see Bull. N. Terr., Dec., 1915.)

Description.—Complete form oval. Head-shield of medium length, semi-circular, smooth. Glabella short, narrow, subconical, mildly convex, sparsely and faintly tuberculate, anterior pair of furrows faint, median and basal pairs fairly

distinct, surrounding axial furrow shallow but distinct. Occipital furrows shallow. Occipital ring strong, smooth, but having an indistinct trace of a median tubercle, arched, lateral extensions strong. Fixed cheeks large, very mildly convex and lower than the glabella. Limb wide, approximately half as wide as the length of the glabella, convex between the front of the glabella and marginal furrow; margin fairly strongly upturned and thickened. Free cheeks unknown. Eye ridges faint and gently arching obliquely to the eye. Eye lobes small and crescentic. Facial sutures anteriorly straight and parallel, posteriorly pass out in front of the genal angle. Thorax consists of thirteen segments, widest at the fourth segment; greatest width equal to its own length and that of the pygidium together. Axis narrow, less wide than one side lobe, tapering very gradually posteriorly, ending with half of its anterior width, convexity moderate. Axial furrows shallow. Side lobes slightly lower at the axial furrows than at the fulera and flat between these points; gently deflected between fulera and margin, margins depressed, ends of segments rounded, free, with little, if any, forward direction; medial furrow of each pleura distinct and reaching just to the marginal end. Pygidium small, subsemielliptic, posterior margin rather straight, mildly tumid. In the axis there are four rings; three pleurae in each side lobe. There is evidence that on each ring of the axis medially there was a tubercle; similarly each pleura of the side lobes was ornamented at its fulerum.

Dimensions: Total length, 23.4 mm., greatest width, 14 mm., length of head, 7.8 mm., of thorax, 12.5, of tail, 3.1 mm. Except for the missing free cheeks this fossil is the finest specimen of a lower Palaeozoic trilobite yet discovered in Australia. If the subgenus *Liostracus* were likely to be retained, the characteristics of our specimen should place it here rather than with *Ptychoparia*. The head-shield of our species resembles that of *P. stracheyi* Reed. The thorax and pygidium are rather closely similar to those of this species, but the ends of the pleurae of the former are rounded and horizontal while those of the latter are pointed and recurved.

The species is dedicated to Mr. A. L. Merrotsky, the discoverer, in whose possession the original still is. The above description was made from a cast, presented to the Australian Museum, Sydney (No. L. 1344).

Locality and horizon.—East of Alroy Downs, Barkly Tableland, N.W. Queensland. Probably of Cambrian age.

EXPLANATION OF PLATE LIV.

Cordania gardneri, n.sp.

- Fig. 1. A nearly complete head-shield. It shows most of its characteristic features belonging to that part of the fossil, except the eyes. (x 2 approx.) Coll. Mitchell.
- Fig. 2. A pygidium, viewed from above. (x 3.)
- Fig. 3. Pygidium viewed obliquely from behind to show the tuberculation.
- Fig. 4. A nearly complete specimen. The glabella is broken away and exposes the hypostome in situ. (x 2½). Coll. Mitchell.
- Fig. 5. A side view of the same specimen shown in fig. 4.
- Fig. 6. Portion of a head which shows the left side very perfectly and the close resemblance it bears to the head of a *Cyphaspis*.
- Fig. 7. Photo. of pygidium, showing serration of axis.

Phillipsia (Griffithides) convexicaudatus Mitchell.

- Fig. 8. A nearly perfect non-testiferous cast. (x 2½).
- Figs. 9 and 10. Photos of a squeeze from the cover of the preceding specimen. They exhibit the details rather clearly. (x 2). Coll. T. H. Pincombe.

Ptychoparia merrotskii, n.sp.

- Figs. 11, 12. Photo. of a plaster cast of the original. (x 2½). Coll. Australian Museum, Sydney, N.S.W.

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